REMARKS

Applicant would like to thank the Examiner for the careful consideration given the present application. The application has been carefully reviewed in light of the Office action, and amended as necessary to more clearly and particularly describe the subject matter which applicant regards as the invention.

THE INVENTION

The present invention is directed to a non-lasing superluminescent light emitting diode (SLED) including a semiconductor heterostructure forming a PN junction and a waveguide defining an optical beam path. The present heterostructure includes a gain region and also an absorber region in series with the gain region along the optical beam path. A first contact is provided for applying a voltage to the PN junction in its forward direction in the in the gain region, so as to produce light emission from the gain region and along the optical beam path.

A second contact is provided for contacting the PN junction in the absorber region and being operable to remove charge carriers generated by absorption in the absorber region. It should be especially noted that, as presently disclosed and claimed, the second contact is not connected to an active voltage source. The present waveguide comprises two end facets, the end facets being perpendicular to the optical beam path. It will be shown that the structure of the present invention as claimed is different from the prior art relied upon by the Examiner.

THE REJECTIONS UNDER 35 U.S.C. §102

Claims 1-3 and 5-18 had been rejected under Section 102(b) as being anticipated by Fouquet (U.S. pat. No. 5,252,839). This rejection is respectfully traversed.

The Fouquet reference discloses a superluminescent LED with a reverse biased absorber (as indicated in the Title, the Abstract and throughout the disclosure). Fouquet provides a reverse biased absorption region to avoid lasing action. Otherwise, feedback would occur from backward emitted radiation reflected by the end coating, which would then stimulate emission in a laser-like manner within the diode, since the diode itself would be a resonator. Within the absorption region, the Stark effect is used to absorb backward emitted radiation (see, inter alia, col. 3, line 45 and col. 6, line 13).

However, in contrast with the Fouquet reference, the present claim 1 recites,

"a second contact contacting the PN junction in the absorber region and operable to remove charge carriers generated by absorption in the absorber region, the second contact not being connected to an active voltage source."

It should be appreciated that a "reverse bias" as according to Fouquet inherently requires a connection to an active voltage source. However, the presently claimed invention includes an absorber region in which the PN-Junction in the absorber region is unbiased, i.e. not connected to an active voltage source. Backward biasing of the absorber is not performed in the present invention, and the Stark effect is not relied upon, as is done with Fouquet. The present invention, therefore, is much simpler than Fouquet's and does not necessitate a further power source to provide the reverse biasing.

In rejecting the above-indicated "second contact" limitation, the Examiner cites col. 6, lines 12-18 and col. 8, line 28 of Fouquet as allegedly showing removing charges generated by absorption in the absorber region at zero bias. However, the passage at col. 6, lines 12-18 actually discloses a split contact in which a forward bias is applied to the gain region and a reverse bias is applied to the absorption region, in order to obtain the Stark effect. This passage plainly fails to satisfy the claim limitation of "not being connected to an active voltage source."

The passage at col. 8, line 28 simply presents an incidental discussion of experimental results that serves to demonstrate the requirement of reverse biasing. Specifically, this passage shows that in Fig. 14A of Fouquet, signal peaks 88 occur due to back facet internal reflection when a zero volt reverse bias is applied. The continuation of this passage shows how, in Fig. 14B, that these internal reflection signal peaks 88 disappear when the absorption region is reverse biased to -4 volts. It is therefore quite apparent that Fouquet maintains a consistent requirement of a reverse bias. Thus, it clear that Fouquet teaches away from the presently claimed invention.

In view of the above, it is respectfully submitted that Fouquet cannot be relied upon to disclose "a second contact... not connected to an active voltage source," as is required by the present independent claim 1. In col. 6, lines 34-40, Fouquet describes the second contact and its function in this manner:

"the second contact is an absorber contact 58 for reverse biasing the absorber region to shift the absorber spectrum therein to lower energy...." (Emphasis added).

In other words, Fouquet teaches that the entire reason for the existence of the second contact is to reverse bias the absorber. This necessitates the connection

to an active voltage source for providing the reverse bias. This necessity of the reverse bias is confirmed throughout the Fouquet reference. For example in the abstract, Fouquet's invention is summarized to be characterized by a reverse-biased absorber region, so that light can be absorbed by Stark absorption or the Franz-Keldysch effect. This is further confirmed in the claims (independent claim 1, col. 10, line 17), where the reverse biasing means is defined to be essential features. In col. 8, lines 14-20, the range of reverse biases for operative examples is set to between –2 V and –4 V.

By requiring reverse biasing, Fouquet teaches away from the invention. This is most clearly illustrated in col. 8, lines 14-35 referring to Figs. 5, 14A and 14B. The experiment comprising the comparison of the spectra reproduced in Fig. 14A and Fig. 14B includes setting the reverse bias to 0V (Fig. 14A) and to compare this with the teaching of the invention, namely to apply a reverse bias (Fig. 14B). From this experiment, as shown above, Fouquet interprets that a 0V reverse bias set-up would lead to back-facet internal reflections (lines 26-28), the avoidance of which is considered essential. For this reason, the skilled person after having read Fouquet's teaching would be led away from zero-biasing the PN junction in the absorber region and would therefore even more refrain from not connecting the second contact to an active voltage source (the latter of which being necessary for reverse-biasing).

Regarding claims 10 and 17, Fouquet at least fails to disclose an unbiased PN junction of the superluminescent light emitting diode. Rather, as set out above, Fouquet clearly and consistently teaches that a reverse bias of the absorber region is essential.

Regarding claim 13, Fouquet at least fails to disclose a light absorbing

semiconductor arrangement being connected to a charge carrier reservoir. Rather, the reference shows the light PN junction in the light absorbing region to be connected to an active voltage source reverse biasing the PN junction in said region.

Regarding claim 19, Fouquet fails at least to show that the second contact forms a permanent electrical contact between a P layer and an N layer of the PN junction in the absorber region. Rather, a permanent electrical contact between a P layer and an N layer of the PN junction would short the same and render a reverse-biasing of the PN junction impossible. However, as set out above, a reverse biasing of the PN junction is an essential feature of an SLED according to Fouquet's teaching.

Claim 4 had been rejected under Section 103(a) as being unpatentable over Fouquet in view of Swirhun et al. (U.S. Pat. No. 5,577,064). Claim 4 and the remaining dependent claims recite many features that also cannot be shown from the prior art. However, these dependent claims are considered to be allowable for at least the same reasons as the independent claims, as stated above. In view of the above, reconsideration and withdrawal of the outstanding rejections is respectfully requested.

In light of the foregoing, it is respectfully submitted that the present application is in a condition for allowance and notice to that effect is hereby requested. If it is determined that the application is not in a condition for allowance, the Examiner is invited to initiate a telephone interview with the undersigned to expedite prosecution of the present application.

If there are any additional fees resulting from this communication, please charge same to our Deposit Account No. 18-0160, our Order No. FRG-15267.

Respectfully submitted,

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